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MEAT PRODUCT CASING HAVING A MAXIMUM EXTENSIBLE DIAMETER  
BACKGROUND AND SUMMARY OF THE INVENTION

This invention relates to a tubular product such as a tubular casing, and in particular to a tubular casing having a predetermined maximum extensible diameter.

The main application for tubular products such as tubular casing of the variety described in this specification is in the food industry. However, the invention is not restricted to this particular application. Tubular products such as knitted netting or elasticated knitted fabric casing are used in the cooking and curing process of meat products. In the cooking of certain meat products, it is common to pack the meat pieces into an elasticated tubular net. The tubular net compresses the meat pieces and holds them together during the cooking process.

Such tubular products are normally removed from cooked meat products which can then be further packaged, ready for sale. Elasticated tubular casing is also used on cured meat products such as ham and metwurst.

The means of filling tubular casing normally comprises fitting the casing onto a hollow cylindrical mandrill, which is known as a stuffing tube, and using a machine to pump or force meat product under pressure through the stuffing tube into the casing. The casing is drawn from the stuffing tube as the meat product is extruded out of the stuffing tube. The process is started by first clipping the end of a casing once sufficient casing is placed on the stuffing tube. Further clips are placed at intervals dependent on the required length of the product.

Such machines can be used either with minced meat products, meat portions or whole meat muscle.

It is difficult to maintain a constant diameter of the resultant product as the casing is being filled. Tubular product that is commonly used such as tubular netting is able to expand to very large diameters. The required diameter is normally

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In its broadest form, the invention is a tubular casing for use with food product that includes,

Preferably, the circumferential threads may comprise either elasticated threads or inextensible threads.

Elasticated thread is normally a combination of rubber thread or strips with natural or synthetic yarns wrapped around the length of the rubber. A large number

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of turns of yarn per centimetre of rubber is normally used to cover the rubber surface. Elasticated threads formed in this way have more than adequate extensibility. In fact, the elasticated threads remain extensible well beyond the desired maximum diameter of the product being produced which allows bulging to readily occur.

In a further aspect of this invention, elastic thread is provided with an elastic limit by controlling the rate at which yarn is wrapped onto the external surface of the rubber thread. It has been found that the elastic limit can be set by controlling the number of turns of yarn per centimetre of elastic thread.

The yarn forms a helix or spiral around and along the length of the rubber thread. As the elastic thread is stretched, the helix or spiral expands so that the helix angle increases thereby enabling stretching of the rubber. At the same time, the diameter of the helix or spiral reduces. If the number of turns of yarn per centimetre on the elastic thread is limited, then the lengthwise expansion of the helix and its continual reduction in diameter will result in a limit being reached whereby further tensile force applied to the elastic thread is resisted by the yarn. This occurs when the yarn helix affectively approximates a straight piece of thread where stretching force results in only tensile force within the yarn.

Although the yarn wrapped around the rubber thread does not completely straighten, it will reach a point where the helix is unable to straighten any further, and therefore approximates a straight length of thread.

Once the tensile force is resisted by the yarn, the elastic thread will not be able to stretch. The elastic thread is then effectively inextensible. That is, further force applied to thread will not result in any additional stretch or extension.

The elastic limit is determined by the number of turns of yarn per centimetre around the rubber thread. The limit can therefore be predetermined, and as such

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A typical method for manufacturing tubular casing is by circular knitting machines. Typical casings are single knit jersey tubes which may incorporate circumferential and longitudinal threads. The circumferential threads normally comprise a single thread that forms a spiral that extends along the length of the tubular casing.

Accordingly, the invention may be utilised in respect of stockinette casings incorporating inextensible or elastic threads as circumferential members. Also, the invention may be used with net casing products where either inextensible or elastic threads according to the invention are used.

In addition, the invention may also be a tubular casing which is a combination of a net and fibrous casings. The fibrous casing is located within and extends along the length of the net casing. Preferably, the diameter of the fibrous casing greatly exceeds the diameter of the net casing in its relaxed form. This ensures, in the case of a net having elastic circumferential threads, that a constant compressive force is applied to meat product as it is forced into the tubular casing.

Preferably, the stuffing process results in embedding of circumferential and longitudinal threads into the surface of the meat product once the maximum diameter is reached. This will serve to produce a pattern on the surface of the meat product once the casing is removed. In the case of a combination of net and fibrous

casing, the maximum diameter of the net is slightly less than the maximum diameter of the fibrous casing to ensure formation of the pattern effect.

## *BRIEF DESCRIPTION OF THE DRAWINGS*

In order to fully understand the invention, preferred embodiments will now be described. However, it should be realised that the invention is not confined or restricted to the precise combination of elements shown in these embodiments. These embodiments are illustrated in the following drawings in which:

Figure 1 shows an elastic thread prior to stretching,

Figure 2 shows a stretched elastic thread at its elastic limit,

Figure 3 shows a tubular casing comprising a knitted stockinette in combination with circumferential and longitudinal members,

Figure 4 shows a tubular casing according to Figure 3 in its filled form, and

Figure 5 shows a tubular casing comprising a combination of a net and fibrous casing.

## *DETAILED DESCRIPTION OF THE DRAWINGS*

Figures 1 and 2 represent schematically the elastic thread 10. It is shown in Figure 1 in its relaxed form and in Figure 2 at the elastic limit of stretchability. The elastic thread 10 comprises a rubber thread 11 which has yarn 12 wrapped around its external surface in a spiral or helix.

The dimension X shown in Figure 1 is the distance between the turns of yarn 12 along the length of the rubber thread 11. As the elastic thread 10 is stretched, the dimension X increases. The same time, the diameter of the rubber thread 11 reduces.

The helix angle of the yarn 12 increases until it reaches a point shown in Figure 2 where further stretching force is resisted as a pure tensile load within the yarn 12. This results from the helix angle being so small that the compressive force applied to the rubber thread 11 reduces to such a point that it is easily resisted by the rubber thread 11. At this point, the yarn 12 approximates a straight line as all of the further stretching force is resisted by the yarn 12. Accordingly, the yarn 12 which is

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substantially inextensible resists any further stretching even though the rubber thread 11 may not be at its elastic limit.

At this point, the elastic thread 10 has reached an elastic limit and becomes effectively inextensible. The point at which this elastic limit is reached, is dependent on the number of turns of yarn 12 for any given interval. The degree of extension can be determined by easy experimentation. For example, a single strand of rubber thread 11 having a 1 mm diameter and approximately 9 turns of yarn 12 per centimetre that is knit into a tubular net having a relaxed diameter of approximately 12 centimetres, will allow the net to expand to a maximum diameter of approximately 20 centimetres. In this example, the net is able to expand an additional 8 centimetres before reaching its maximum diameter. This enables the elasticated net to be pulled onto a stuffing tube which has a diameter of 17 centimetres. It will result in a meat product having a maximum diameter of 20 centimetres and bulging will be resisted beyond this diameter due to reaching the elastic limit of the circumferential elastic threads.

A tubular net or tubular casing using circumferential elastic threads 10 will continue to apply considerable compressive force to meat product within once it reaches its maximum diameter. This compressive force will be maintained even though there may be some further shrinkage of the meat product.

The elastic limit of the elastic thread 10 can be produced in a number of ways. As described above, it is common to wrap yarn 12 in a helix around rubber thread 11. However, other wrapping patterns may be used such as multiple yarns 12 wrapped in different directions, or the use of a rubber material which may itself exhibit inextensibility at a given limit of stretch.

Figures 3 and 4 show a tubular casing comprising longitudinal threads 13 and a circumferential spiral thread, referred to herein as a circumferential thread 16, in combination with a knitted tubular stockinette 15. The circumferential threads 16 are

held to the tubular stockinette 15 via tuck stitches 17 and the longitudinal threads 13 comprise knitted loop stitches where a single loop extends from each circumferential thread 16 to loop around the corresponding loop stitch of a lower circumferential thread 16.

The circumferential threads 16 comprises an elastic thread 10 having an elastic limit of stretch. Once the tubular casing shown in Figure 3 reaches the maximum diameter of the circumferential threads 16, the tubular stockinette 15 remains stretchable, which allows some further expansion within the area bounded by the circumferential and longitudinal threads 16 and 13. This results in a quilted surface pattern which is illustrated in Figure 4.

The tubular stockinette 15 remains substantially impermeable to meat product that is placed within the tubular casing. This remains the case even though the meat product may be finely minced. Compression applied by the circumferential threads 16 compresses the fibres of the meat product at the surface which tends to seal the surface against any moisture loss. This has a significant advantage in respect of maintaining weight during the cooking or curing process.

As an alternative, the circumferential threads 16 of the embodiment shown in Figure 3 may comprise inextensible threads which are held to the surface of the tubular stockinette 15 via the tuck stitches 17. These circumferential threads 16 will lie loosely across the surface of the tubular stockinette 15 prior to filling. However, these circumferential threads 16 will limit expansion of the tubular casing to a set diameter and accordingly the expansion of the tubular stockinette 15 will be limited. At this point, some further expansion of the stockinette may occur depending on the pumping pressure of meat product being inserted within the tubular casing. This can result in further expansion of the tubular stockinette 15 with both the longitudinal and circumferential threads 13 and 16 being embedded into the surface of the meat product to again produce a quilted surface pattern shown in Figure 4.

The tubular casing illustrated in Figure 3 and 4 can be continuously produced in a circular knitting machine both for the version using the elastic thread 10 or an inextensible thread. This knitting process results in both the longitudinal and circumferential threads 13 and 16 being located on the external surface of the tubular stockinette 15.

Figure 5 shows a further embodiment of the invention in which the tubular casing is a combination of a tubular net 19 in combination with a tubular fibrous casing 20. The tubular net comprises a circumferential thread 21 which is a single thread forming spiral along the length of the tubular net 19 and longitudinal threads 22 which each comprise a number of loop stitches to form a continuous longitudinal thread 22.

In this embodiment, the circumferential threads 21 comprise elastic threads 10 having an elastic limit of stretch.

The fibrous casing 20 has an unfilled diameter which exceeds that of the relaxed tubular net 19 by a factor of between 2 and 4. In order to locate the fibrous casing 20 within the tubular net 19, it is folded or pleated as shown in Figure 5. This ensures that, as the fibrous casing 20 is being filled, the circumferential threads 21 apply a compressive force throughout the filling process.

In this embodiment, the diameter of the fibrous casing 20 is matched to the diameter at which the circumferential threads reach their elastic limit. In this embodiment, the maximum diameter of the tubular net 19 is slightly smaller than the maximum diameter of the fibrous casing 20. This results in a slight embedding of both the circumferential and longitudinal threads 21 and 22 within the surface of the fibrous casing 20. This produces the quilted pattern effect similar to that shown in Figure 4.

**SECRET**

It will be seen from the above description, that the invention will be extremely useful, and will provide a tubular casing which itself can control the maximum diameter of the meat product inserted within.